IT Needs Analysis for the Central Bank of Jordan

Final Report

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Data Page

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Intrusion Detection
Network Design
Network Requirements
Real Time Gross Settlement
SWIFT Network

Abstract

This report includes a detailed Information Technology Needs Assessment for the Central Bank of Jordan (CBJ) and a comprehensive network design and specifications for the new proposed CBJ wide area network (WAN). The new WAN will connect the CBJ with all commercial banks in the country and enable the CBJ to connect to other financial institutions in the future as necessary. In addition, the proposed WAN will support the implementation of sophisticated software applications designed to further enhance the CBJ's capabilities and service offerings and help Jordan's banking sector meet or exceed current global banking standards.

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Executive Summary

The Central Bank of Jordan's (CBJ) existing information technology infrastructure requires updating in order for the CBJ to continue to implement its comprehensive strategy to modernize the bank's operations and help make Jordan's banking sector a competitive part of the global economy. The AMIR Program's Financial Markets Development and Information and Communications Technology Initiatives in close cooperation with the CBJ's Information Technology Department conducted an exhaustive information technology needs assessment to determine the system enhancement requirements necessary to transform the existing CBJ wide area network (WAN) into a more effective, efficient and secure communication infrastructure.

The existing CBJ WAN only connects the CBJ's Amman, Aqaba and Irbid offices. It does not provide connectivity with any Jordanian banking institutions and does not provide adequate resources to support advanced software applications which the CBJ needs to implement in order to adhere to internationally accepted best practices.

The CBJ is currently working to implement an electronic check clearing system and an early warning system. These high performance applications demand a powerful communication network to operate properly and ensure security for investors.

The new proposed CBJ WAN infrastructure will serve all three CBJ locations and provide connectivity to all banking institutions in Jordan and can provide connectivity to other financial institutions as required. Moreover, the proposed WAN will enable the CBJ to modernize its service offerings and continue implementation of key applications.

As part of the IT needs assessment, AMIR employees met with CBJ and Jordan Telecommunications Company (JTC) executives to ensure that JTC could accommodate the technology requirements of the proposed WAN. JTC confirmed that the company can provide the required technology to support the establishment of the WAN and advised the CBJ to become the owner of the network in order to maintain a single point of contact for network management and control.

The AMIR team finalized a comprehensive new CBJ WAN design after evaluating bandwidth demands, available technologies and all CBJ requirements. The design details all required equipment and illustrates how it will be connected. The proposed highly secure, redundant WAN employs the most sophisticated technology available and meets or exceeds all CBJ communication infrastructure requirement estimations for at least the next five years.

Information Technology (IT) Needs Analysis

Central Bank of Jordan (CBJ)

April 20, 2004, Draft

Communication Infrastructure

Introduction

For the Supervision Department the technical assistance by the AMIR Program on IT related matters will result in an IT Needs Assessment. In this assessment a review of the existing IT systems within the Supervision Department will be given. At the same time recommendations will be given on new applications and systems needed for the future tasks of the department.

As the IT Needs Assessment normally includes an assessment on the communication infrastructure requirements, the AMIR Program decided to take the communication part of the Supervision Department assessment into a separate document as the communication infrastructure will have to serve all departments of the Central Bank and not only the Supervision Department. It is for this purpose that this document has been prepared.

Communication Infrastructure Assessment

Communication Objectives

This document defines the Communication Infrastructure needs and requirements for developing a cost-effective network for the Central Bank of Jordan (CBJ). This section describes the infrastructure requirements and needs from a functional perspective.

The main objective is to build a common communication infrastructure in order:

- To extend the existing CBJ Net to a more effective, efficient and secure communication infrastructure network for the Central Bank of Jordan
- To achieve maximum sharing of available network resources for the CBJ, it's branches in Irbid and Aqaba, the commercial banks in Jordan and other participants in order to save on costs both for the CBJ, participants and the commercial banks;
- To be ready to serve the present and future applications of the Central Bank of Jordan
- To build a common shared and as fail-safe as possible network given the communication offerings of the Jordan Telecommunications Company (JTC) and other telecommunication providers in Jordan;
- To be ready to take advantage of Internet connectivity possibilities and to be able to offer alternative access possibilities for participants of the systems in comparison with fixed leased line costs;
- To provide high level security for all users by applying features and functions (i.e. Communication Authentication, Encryption, Digital Signature, Authorization, Firewall, etc.) to guarantee privacy and confidentiality and to protect against intruders into the systems.
- To be ready to serve a new to be established Disaster Recovery site for CBJ.

We have focused this Needs Analysis on our recommendations regarding the communication infrastructure for the years to come given the above mentioned objectives.

CBJ existing LAN/WAN Network

The existing CBJ Network serves a number of applications presently operational at CBJ. In a number of diagrams we have outlined the basic structure of the presently installed WAN/LAN Network at the CBJ Premises. The existing running applications are: General Ledger (G/L and Accounting), CBJ Signature Verification, RTGS and SWIFT Gateway, E-Mail services, Supervision (Back Office Operations).

The 3 diagrams give a schematic overview of the existing WAN/LAN Network of the CBJ. The first diagram shows the existing WAN Network followed by a diagram of the existing installed and operational applications and the last diagram showing the existing system platforms on which the mentioned applications are running. The last diagram also outlines the basic structure of the CBJ LAN Network at the CBJ premises.

Diagram 1; Existing CBJ Net. The existing WAN/LAN Network main purpose is to interconnect the CBJ to it's remote locations in Irbid and Aqaba, to have dial-in possibilities for the Jordan Banks and to serve the need for internet connectivity for the CBJ staff. A SWIFT Gateway has been installed for the Real Time Gross Settlement (RTGS) application at CBJ. Messages for the RTGS system (from and to banks) presently are making use of the international ***SWIFT Network***.

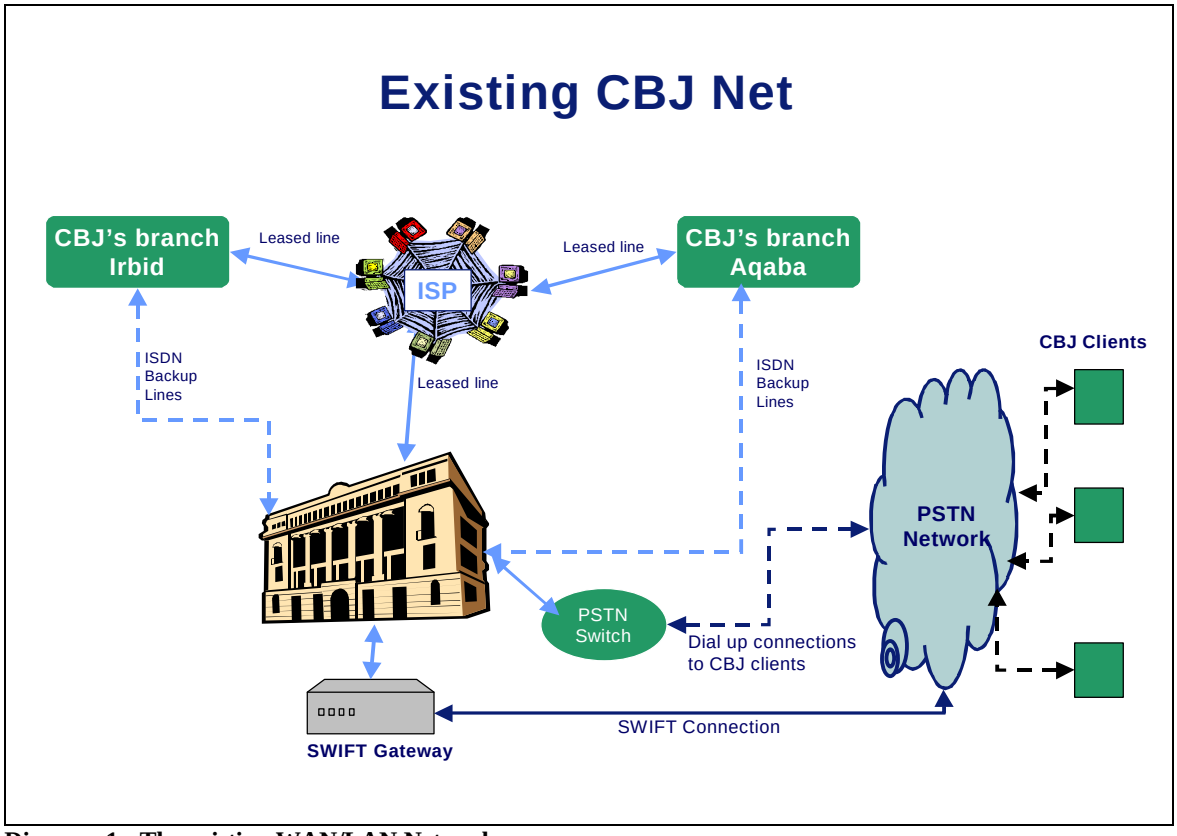


Diagram 1: The existing WAN/LAN Network

Diagram 2; Existing Systems; It outlines the installation of the bank's main servers (applications) on the LAN network inside the bank's main premises.

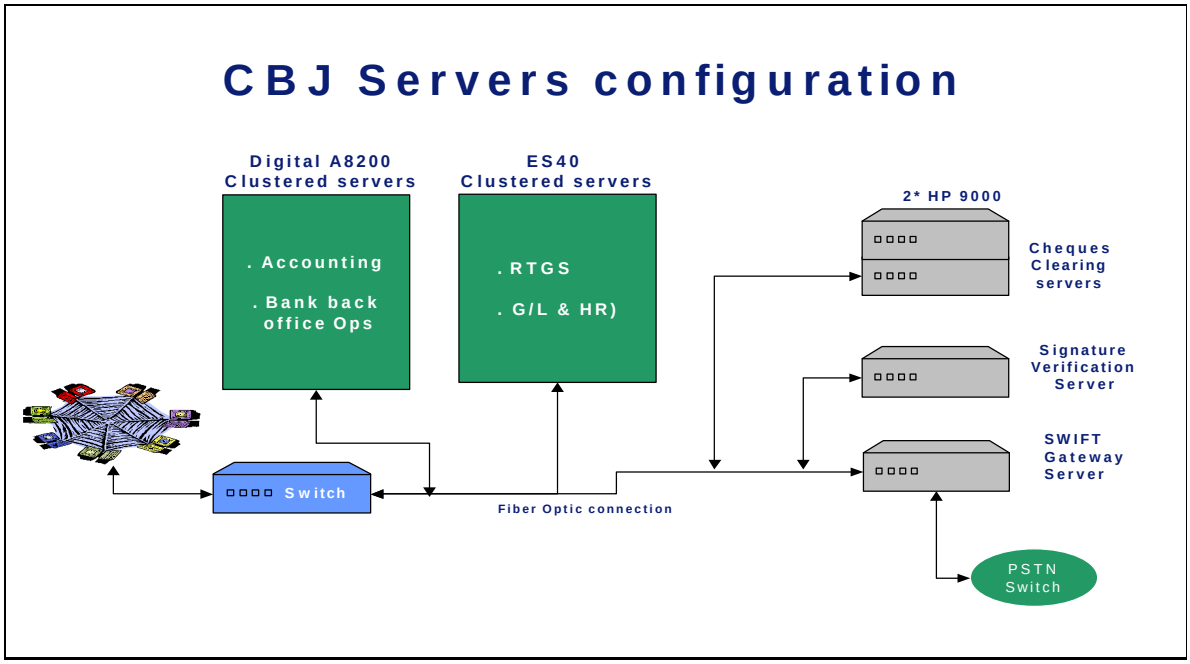


Diagram 2: Present CBJ Server usage

Diagram 3 Network Equipment; It outlines the present WAN/LAN installation and shows the installed server and communication infrastructure equipment.

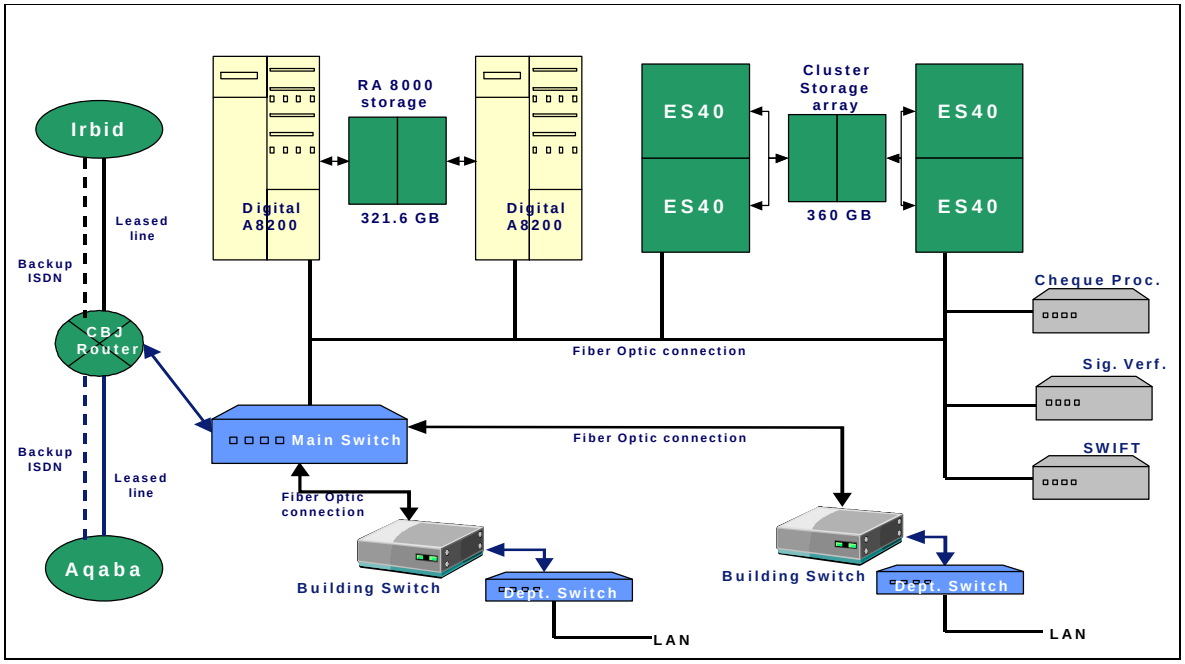


Diagram 3: Existing LAN/WAN Network

Existing disaster and backup site location

The CBJ has not yet made a serious effort in the set-up and implementation of a disaster recovery site. Recovery plans and implementation so far relate to single computer system failures only, for which solution are implemented by CBJ IT and provide some form of "cold/warm" backup situations on their clustered servers in their main premises.

In this communication infrastructure analysis we have taken plans for disaster recovery into consideration and assumed that a recovery site within the next 2 years will have to be built in a different location in Jordan. The CBJ mentioned that it is expected that the CBJ Irbid branch to be assigned as the location for the disaster recovery. The first application which probably will be implemented on this disaster recovery site will be the new Electronic Check Clearing system (ECC).

However, the total requirements and output of the ECC System can not be determined at this stage, the CBJ has to go through many stages of testing and shadow-run of the system before determining the real needs of the system and thus preparing for a real disaster recovery site.

Future disaster recovery plans for the CBJ will have to cover a broader spectrum of backup and recovery services and will have to include plans for business resumption. When further plans are worked out in the near future, the new communication infrastructure will have to be adopted and changed to cope with the then required communication environment.

The New CBJ Network

The installation of a new network for the CBJ is required by the need for a better and more high performance communication infrastructure given the installation and/or replacement of a number of (new) applications. These new applications in order to operate properly will have to rely on a more powerful (higher bandwidth) communication network The applications are:

1. The new Electronic Check Clearing System (ECC)
2. Early Warning System (EWS) for the Supervision Department
3. Anti Money Laundering System

Some further details about these new applications and information on changes required for the existing applications.

1. ***Electronic Check Clearing (ECC) System***. The CBJ has issued in August 2003 an RFP for a new Electronic Check Clearing system (ECC). This new ECC system will be used for the electronic clearing of all inter-bank checks; intra-bank checks will be handled within the bank's own check processing environment. At the branch in which the checks are presented for clearing, a digital image of the check will be made (by check reading equipment). The image of the check (around 100K) will after being verified be transmitted over the network to the check issuing bank branch (account). The receiving branch verifies the check for validity (signature, account info, check number, amount, etc.). If proven okay the bank will electronically return the check back as being approved.

   The main reason for the implementation of a new ECC system is to facilitate and speed up the process of inter-bank check clearing. The new ECC system will replace the present installed system for mainly manual check handling. At present (manual) inter-bank check clearing takes between 3 – 5 days. The new system will bring back the clearing time to around 20 minutes. An average of 40K to 45K checks are cleared daily with peaks (mid and end year) close to the 100,000 (inter-bank) checks per day.

RFP is due in November 2003 and the pilot installation, according to the requirements and conditions of the RFP, should be up and running in April 2004. Gradually over 2004 all banks will be connected to the system. The RFP indicates the need for future backup facilities. It is also requested from the bidders (for information purposes only) to get an indication for the cost of a fully equipped backup site. It is expected that later in 2004 or early 2005 CBJ might purchase and implement a disaster recovery site for this application in their Irbid branch. No fixed plans for a disaster recovery plan established yet although CBJ mentioned that given the importance of the new ECC, it is somewhat likely that the disaster recovery site will be implemented.

2. ***Early Warning System (EWS)***. As part of the AMIR Program initiative the Program is working with the Supervision Department of the Central Bank to initiate a new supervisory program, which is more inline with standard practices for Supervision as recommended by the Bank for International Settlement (BIS) and to be ready for a Basel II implementation. Part of the initiative is to revamp the existing on- and off-site inspection and applications. For the off-site inspection the CBJ IT team is developing new Oracle based applications in order to be able to gather the appropriate information from the banks (end of day file upload from the banks). For the on-site inspection the AMIR Program with the help of the FDIC is defining specifications for a new on-site inspection program.
3. ***Anti Money Laundering System (AML)***. Sometime in 2004 the AMIR Program will initiate this project at CBJ. For Anti Money Laundering (AML) no further details are presently available. It is expected that after July 2004 more information will become available; the AML project has been identified but no time table has been set yet.

Besides the mentioned new applications some existing applications will also make use of the renewed infrastructure. Applications are:

4. ***Real Time Gross Settlement (RTGS) system***. In today's dynamic and increasingly global financial market, the clearing and settlement processes comprise a core foundation for financial stability. As a result, secure interchange of payments and a robust financial infrastructure is a primary obligation for leading financial institutions. The CBJ RTGS system is presently installed and operational. CBJ has installed a RTGS server (clustered server) in their premises. Schlumberger / SEMA has implemented and installed the RTGS system at CBJ. The total price of the project was around US$ 1M.

   RTGS handles the actual transfer of funds between the payer's bank and the payee's bank. Settlement discharges the obligation of the payer bank to the payee bank in respect of the transfer. The settlement of inter-bank funds transfers are based on the transfer of balances on the books of a central bank (i.e. central bank money) or commercial banks (i.e. commercial bank money). Settlement of large-value funds transfer systems takes place in central bank funds.

   The main objectives of the RTGS system are the following:
   - ? to increase the speed of transactions within the banking system
   - ? to reduce the banks' settlement risk by finalizing inter-bank settlements;
   - ? to provide for the possibility of intraday liquidity management by participants;
   - ? to settle transactions in an organized securities market the same day;
   - ? to allow participants to consolidate their resources in one location.

On a daily basis around 400 transactions are being handled by the RTGS system. The communication used for the RTGS application is being provided by the SWIFT (SWIFT Network). Given the upcoming installation of a new CBJ Network, The new Network will be able to handle RTGS if decided by CBJ in the future

It has to be stated here that some (program) modifications to the installed RTGS system will be required to be able to use the new CBJ Net.

5. ***E-Mail services***. The CBJ has 2 e-mail services; one for internal only use based on Microsoft Exchange and one for external use based on UNIX.

6. ***Other Applications***

All other applications (mostly General Ledger, Accounting) are for internal use in CBJ.

Given the above mentioned applications, the Central Bank of Jordan Network structure will have to serve the following institutions:

- The Central Bank of Jordan;
- The 2 branches of the CBJ in Irbid and Aqaba; Central Bank's upcountry outlets;
- The 21 (Commercial, Foreign, Islamic and Investment) Banks in Jordan;
- Other financial institutions i.e. the SDC (clearing cash transactions for equities), etc.

The 21 (Commercial, Foreign, Islamic and Investment) Banks in Jordan are the following:

	A. Commercial Banks.
1.	Arab Bank PLC.
2.	Arab Banking Corporation (Jordan)
3.	Bank of Jordan PLC
4.	Cairo Amman Bank
5.	Export & Finance Bank
6.	Jordan Gulf Bank
7.	Jordan Kuwait Bank
8.	Jordan National Bank PLC
9.	The Housing Bank for Trade & Finance
	B. Foreign Banks.
10.	Standard Chartered Grindlays Bank Ltd.
11.	Egyptian Arab Land Bank
12.	HSBC Bank Middle East
13.	CitiBank
14.	Rafidain Bank
	C. Islamic Banks.
15.	Islamic International Arab Bank PLC
16.	Jordan Islamic Bank for Finance and Investment
	D. Investment Banks.
17.	Arab Jordan Investment Bank
18.	Jordan Investment and Finance Bank
19.	Middle East Investment Bank Societe General de Banque Liban
20.	Philadelphia Investment Bank
21.	Union Bank for Saving & Investment

Table 1: Banks in Jordan

Locations of the Central Bank of Jordan, Banks and other participants

At present 3 locations are in use for the Central Bank of Jordan:

CBJ Head Office Building:
The CBJ Head Office Building is situated in downtown Amman. The CBJ has their offices and a well equipped computer room in this building. The CBJ Head Office building is equipped with a LAN/WAN network to accommodate the existing applications. Upgrade and extensions on the WAN network were foreseen as a number of new applications and services will be implemented in the near future (new Electronic Check Clearing system including a new Credit data base, an Early Warning System for Supervision and an Anti Money Laundering System)

An UPS system has been installed in the building to support the equipment in the computer room and some of the peripheral equipment (PCs and printers) from power outages. Also a generator has been installed in the building. The computer room is equipped with a fire protection system.

CBJ's 2 Upcountry & Down country Branches
The Irbid and Aqaba Branch are the Central Bank's 2 upcountry outlets for services to the Jordanian public. It is expected that the Irbid branch will serve as the future backup and disaster recovery site for the Central Bank.

The Jordan Banks

A total of 21 Commercial, Investment, Islamic and Foreign Banks have been established in Jordan. All the banks have their head-offices situated in the Amman Metropolitan Area. Present application which communicate with the Central Bank via dial-up lines is for Banks' Supervision. New applications under development will be Early Warning System (Supervision), new Electronics Check Clearing, RTGS and Anti Money Laundering.

Other Participants

In the near future it is expected that the Securities Depository Center (SDC) will be connected to the RTGS system for the cash settlement of equities. Decision will depend on the fact if the SDC selects the CBJ or one of the Jordanian Banks to perform their financial settlements transactions. In case the SDC settles their transactions through the Central Bank, SDC will become a participant for the new CBJ Net.

WAN Connections in Jordan, an overview

To implement Wide Area Network connections (mostly referred to as remote-access), companies have a number of options available to them, each with their own set of advantages and disadvantages. Some of the most commonly examined options in Jordan for providing corporate remote-access include the following:

- **Public switched telephone network (PSTN)-based solutions** -- These include modem banks and telephone lines.
- **Integrated services data networks (ISDN)** -- This is a digital upgrade to PSTN, offering up to 128Kbps of channel capacity on a single basic rate interface (BRI) line.
- **Internet access and virtual private network (VPN) technologies** -- These leverage the global, public Internet to provide secure, remote-access.

For companies that need to provide access to the corporate network from a wide variety of locations, PSTN, ISDN and Internet-based solutions with VPN technologies are the most practical solutions. While setting up a simple modem-based solution for corporate access has a low entry cost, expenses rapidly escalate as the volume of users and their geographic mobility

increases. Corporate remote-access solutions based on Internet and VPN technologies are highly cost-effective.

WAN connection possibilities in Jordan:

Jordan Telecommunications Company (JTC), a state owned monopoly, offers a full range of analog- and digital based communication services within Jordan. The Digital Network Services are ISDN BRI (Basic Rate Interface), ISDN PRI (Primary Rate Interface) and leased lines for speeds from 64 Kbps up to 2048 Kbps (E1 line). The services are offered in almost all of Amman and in most parts of Jordan, depending on the public exchanges (PBXs) used in a particular area or part of the country.

Besides the telephone line offerings, JTC offers for leased lines the service to truncate telephone lines in their PABX system in order to limit the number of outgoing lines from the PABX to the customer location. In some cases fiber optic solution can be offered. JTC sells it as a bandwidth service (only supplying customers the required bandwidth they need on the fiber cable). JTC is working with their counterparts to provide additional services (backup and recovery facility management, etc.)

Remark: We do recommend the CBJ-IT team start to have regular meetings with JTC in order to inform JTC about the bank's specific network requirements. Given the CBJ existing requirements for high bandwidth & reliability and the upcoming need for CBJ to establish their backup site (and thus networking capabilities) those discussions should start immediately. JTC is willing to cooperate with their key corporate customers to enhance their services and connectivity possibilities. Also JTC mentioned that they will be able to provide additional services (backup site, etc.).

The Design:

For designing the new CBJ Network we have taken the communication objectives as mentioned in the introduction as guidance. Besides the general requirements we have taken the following design technical criteria for the new network into consideration:

Basic Design

1. The existing LAN Network and remote connections to the Irbid and Aqaba branches are functioning good and serve the existing (mostly internal) applications. The design of the internal LAN Network at CBJ premises in Amman is solid and based on a high availability main switch and several departmental and building switches interconnected via fiber and/or UTP cabling. There is no need for replacement of the existing LAN network inside the Central Bank.
2. For all new applications, which require to have access to the WAN Network in order to communicate with CBJ's participants, we decided to establish a so-called Networking Application Area (NAA). This NAA is a DMZ (Demilitarized Zone), in order to offer high security.
3. The existing CBJ Net is controlled by a main (high-availability and existing) network switch. This core switch has sufficient capacity and will act as the "gateway" for data coming from the new applications (in the application area), if there is a need that some of this data have to be directed to CBJ's internal systems.
4. The new Network should provide sufficient bandwidth (main links) for the ECC, RTGS and Supervision applications. Required bandwidth has been calculated on the given peak information of the central bank plus a 5% annual growth for the application data for the next 5 years (see network calculation).
5. Besides the main (primary) links, the network will provide possibilities for backup dial-in facilities based on a combination of BRI / PRI links in case the main (primary) links are down.
6. CBJ prefers to start with a data backup site and not a full disaster recovery site as the full disaster recovery site requires a complete disaster recovery strategy to be considered and a complete evaluation and modification of the current CBJ applications in order to run in a disaster recovery mode.

   JTC is offering a number of options for connectivity between the main CBJ site in Amman and the backup site in Irbid depending on the bandwidth required between the main site and the data backup site and also depending on the time to implement this project, those options are:

   1. If the connection between the two sites is required in the next 1 to 2 months:

      a. And if the required bandwidth between the two sites is more than 30 Mbps, JTC is welling to offer an E3 connection with a bandwidth of 34 Mbps, the media for this kind of connection is fiber and requires an STM1 module in addition to a router that can handle such connection on each side. The cost of the equipment on both sides of the connection is around $120,000.00 which is very expensive and technically exceeds CBJ bandwidth requirements between the two sites.

b. If the required bandwidth between the two sites is around 10 Mbps, JTC is offering to supply a multiple of E1s connection, 5 or 6 E1s will be required to supply a 10Mbps or 12Mbps connection, the media for this connection is copper and requires 5 or 6 G.703 modules in addition to a router that can handle this number of interfaces on each end of the connection, the number of modules should correspond to the number of supplied E1s. The cost of the equipment on both sides of the connection is around $40,000.00 which is more reasonable than option 1.b and technically meets CBJ bandwidth requirements between the two sites.

2. If the connection between the two sites can be delayed for 3 to 6 months, JTC might be able to offer a new option to connect the data backup site to the main site, this option will be based on Gigabit Ethernet technology with single mode fiber media, this kind of connection requires single mode fiber modules and a 2nd layer switch on each side of the connection. The cost of the equipment on both sides of the connection is around $10,000.00, which is the best in price, meets the CBJ bandwidth requirements between the two sites and the most technically recommended for such solutions.

Therefore, it was agreed between the AMIR Program and CBJ IT to delay the data backup site implementation of this project until the beginning of 2005 for the following reasons:

- The most technically recommended and reasonably priced connectivity option between the CBJ main site in Amman and the backup site in Irbid is not available until probably 6 months from now.
- The ECC system will need at least until the beginning of 2005 to be established and up and running.
- The year 2005 is also the end of JTC monopoly and more connectivity options could be available at that stage.

7. By eliminating the data backup site part from the plan for now, we still can go ahead in implementing the main CBJ site connectivity with other banks and keeping the data backup site in mind for the next year implementation and noting that this scenario will not form any problem in implementing the ECC system and the backup site can be added at any stage in time if required.
8. This IT Needs Assessment only specifies the communication and other networking equipment needed at the Central Bank (CBJ IT Needs Assessment for Networking). The assessment also specifies and includes the requirements for security and network management (hardware and software).
9. Any equipment needed by the Banks (and other participants) to establish a link to the Central Bank on their premises will be the Banks' own responsibility. Central Bank will advise and prescribe the participants what equipment and security features are needed to establish the connections to CBJ.

10. After we finished the initial design for the new CBJ Net we have involved Jordan Telecommunication Company (JTC) in our discussions to see if JTC can meet the network requirements.
11. JTC offered during the discussions the following basic options for the network connections:
    i. Each bank to be connected to the CBJ Net on their required bandwidth as calculated; i.e. multiple type connections which vary form 64Kbps to multiple E1s (see network calculation) to be handled by CBJ (router equipment);
    ii. JTC will be able to truncate the individual lines of the banks (as described in i) on their equipment into multiple (14) E1 lines and these will be connected to the CBJ Net. The network calculations showed that approx. 14 E1 would be needed to serve the bandwidth requirements of the mentioned applications.
    iii. Given the required bandwidth of 14 E1 lines (see ii), JTC could provide CBJ with a fiber optic link from JTC truncation equipment to the receiving router at CBJ. In this solution CBJ will (on request of CBJ and when needed) be able to provide an additional and alternative (backup) fiber to CBJ.
12. For a project of this size and networking requirements, AMIR and JTC advised CBJ to become the owner of the network as for management and control purposes it would be better to have single point of contact. Some of the objections as raised by CBJ related to this approach (invoicing, single point of contact, etc. for services) were solved by JTC.
13. CBJ indicated that option iii as mentioned under item 11, has their preference as this would make the network connections easy to configure and better manageable. CBJ has discussed the network design based on option 3 with the committee of the banks responsible for the ECC system. Banks agreed that also from their point of view option 3 was preferred.
14. All network related costs (lines, installation, subscription, maintenance, etc) from JTC are considered by AMIR to be operational costs and as such will have to be paid for by CBJ.
15. The data over the network will be encrypted using a VPN 3DES based technology.
16. In our discussions with the CBJ IT Team, it was mentioned that the network should provide Intrusion Detection (IDS) and Network Management capabilities.
    i. Intrusion Detection will include Network-based intrusion detection features as well as anomaly, misuse, etc. detections.
    ii. The Network Management System should provide comprehensive functions and features for managing the network and computer environment.

Besides the above mentioned design criteria the following activities were undertaken by the CBJ IT Team and the AMIR Team to justify and verify the network design and it's requirements:

a. Meetings were held with the technical and business/account representatives of JTC to discuss the requirements of the Central Bank's network. Meetings were also held to see what network options JTC can offer and if those options complied with our overall network requirements. JTC confirmed that the requirements for the CBJ Network could be met and even suggested to take into consideration some additional feature and services JTC is able to provide (backup and recovery site facilities, alternative routed backup fiber link from JTC to CBJ, etc).

b. CBJ IT and AMIR have prepared spreadsheets for the calculation of the estimated traffic volume (required bandwidth) for the network. For each of the 3 applications which will be using the network, traffic calculations have been made. Traffic calculation have been based on data provided by CBJ. Data provided included the number of messages on peak days, growth over the next 5 years, peak hours during the day and indications of how many percent of the messages are being handled during the peak hours. Finally all calculations have been combined to see the overall required bandwidth needed on the network to serve all 3 applications.

c. CBJ IT has specified the requirements for a basic network management and intrusion detection system to be provided with the new network environment.

Network Calculations

Sheet 1: Peak Day Check Handling

The first sheet of the network calculations (Peak Days for Check Handling) gives the number of inter-bank checks handled by the banks. Number are given for the peak periods mid-year and year-end as these period have shown the highest numbers of checks to be handled. For each bank we have taken the highest number of checks handled in those periods for the network calculation.

Sheet 2: Check Handling Bandwidth Calculation

Given the number of checks on peak days by each bank (sheet 1), we have increased this number by an annual growth of 5% per year for a 5 years period. The 5% increase was proposed by CBJ IT and was seen as a realistic indications for growth of the volume of checks for the years to come.

In the calculation we have used the following information to reach the required bandwidth of each bank for the ECC application.

1. The image of a check after being scanned (check reader) will be approx. 100K bytes.
2. Messages pass through the network twice (from bank where the check is presented via the CBJ ECC system to the check issuing bank)
3. For security (VPN based) we have added 10% overhead on each message
4. Besides the normal traffic of sending and receiving checks we have added a 25% overhead for message inquiry. Inquiry messages do include the scanned check image.
5. For peak load calculation we have taken 3 options:
    a. Option 1: 30% of all checks to be handled in 2 hour
    b. Option 2: 40% of all checks to be handled in 2 hour
    c. Option 3: 50% of all checks to be handled in 2 hour
    d. Remaining load equally distributed over the remaining working hours of a branch
6. Maximum allowable load on a given line set to 90%

The calculation in this spreadsheet results in **The Required K-bits/sec** for each of the banks for the ECC application.

Peak Hour indications for ECC and RTGS application

The branches of the banks in general have their opening hours from 8:30 till 15:30. Some of the banks like HSBC have extended opening hours. In the discussion with the CBJ IT, it was mentioned that from their experience, 50% of the checks were handled between 10:00 and 12:00 hours. Another peak was seen from 14:00 till 15:00 hours giving another 25% of the check to be processed.

The bar chart below indicates the peak hour information for check handling at the branches of the banks. The 50% peak for the 2 hours have been translated in a 25% per hour. The chart indicates that 75% of all checks will be processed in 3 hours, while the load of remaining checks have been equally distributed of the rest of the branch opening hours.

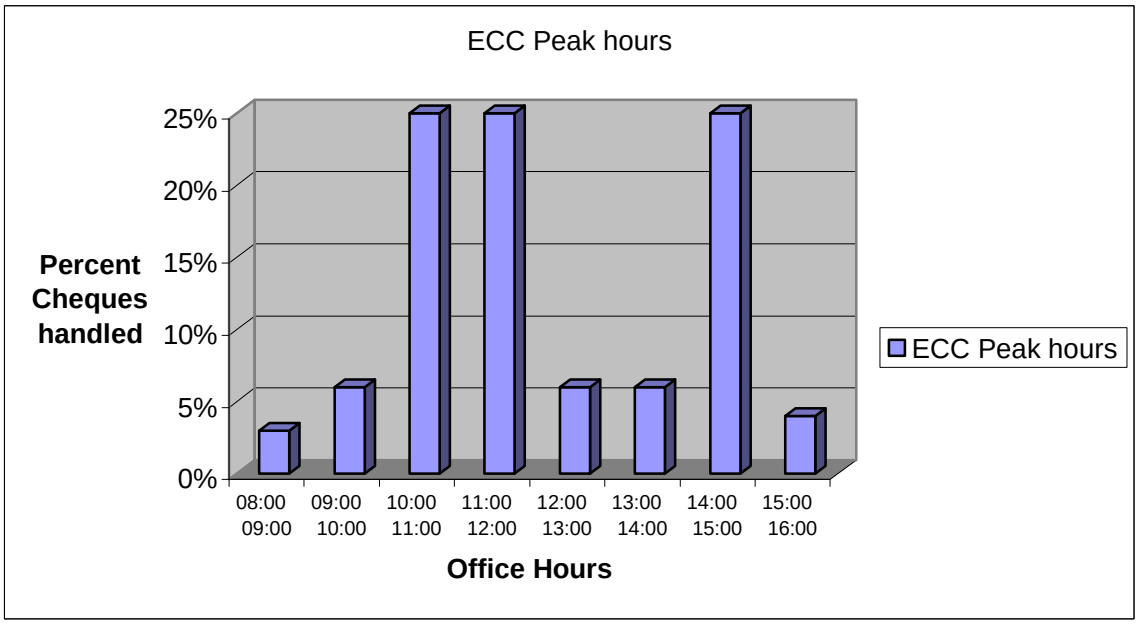


Table 2: ECC Peak Hours

The RTGS application according the CBJ IT team follows a similar pattern in transaction handling over the day. So for the RTGS application we have taken the same distribution model of messages over the opening hours of the banks' branches.

Sheet 3: RTGS Transactions Bandwidth Calculation

Given the number of RTGS transactions on peak days by each bank, we have increased this number by an annual growth of 5% per year for a 5 years period. Added here the Securities Depository Center (SDC) for their transaction of the cash settlement of the securities.

In the calculation we have used the following information to reach the required bandwidth of each bank for the ECC application.

1. The transaction length of an RTGS transaction will be approx. 2K bytes.
2. For security (VPN based) we have added 10% overhead on each message
3. Besides the normal traffic of sending and receiving RTGS transactions we have added a 25% overhead for RTGS message inquiry.
4. Messages pass through the network twice as the set-up for the RTGS is an Y-shaped network, every transaction is sent to CBJ first before it is received at the corresponding bank for that transactions

5. For peak load calculation we have taken 3 options:
    a. Option 1: 30% of all RTGS transactions to be handled in 2 hour
    b. Option 2: 40% of all RTGS transactions to be handled in 2 hour
    c. Option 3: 50% of all RTGS transactions to be handled in 2 hour
    d. Remaining load equally distributed over the remaining working hours of a branch
6. Maximum allowable load on a given line set to 90%

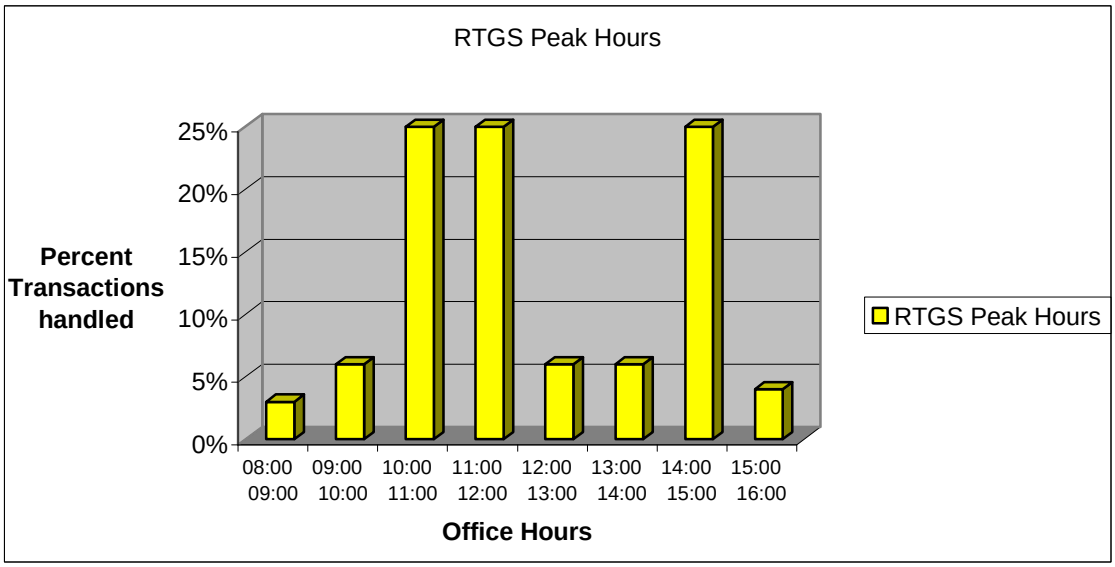


Table 3: RTGS Peak Hours

The calculation in this spreadsheet results in **The Required K-bits/sec** for each of the banks for the RTGS application.

Sheet 4: Supervisory Transfer Bandwidth Calculation

The Supervision daily transactions are being processed and put on the network after the closing of the branches and the banks have prepared their information as required by the Supervision department of the CBJ. Information will be uploaded to the CBJ in text files containing the required information. Given the fact that the application is under development and no statistics are available we have estimated that each bank will be use around 100 transactions in the text file.

The following information to calculate the required bandwidth for the Supervision (EWS) application:

1. Transaction length is 2K bytes
2. VPN security overhead is 10%
3. Transactions take place after 15:00 hours and a total of 2100 transaction to be handled
4. Load will be at 100%
5. Maximum allowable load on a given line set to 90%

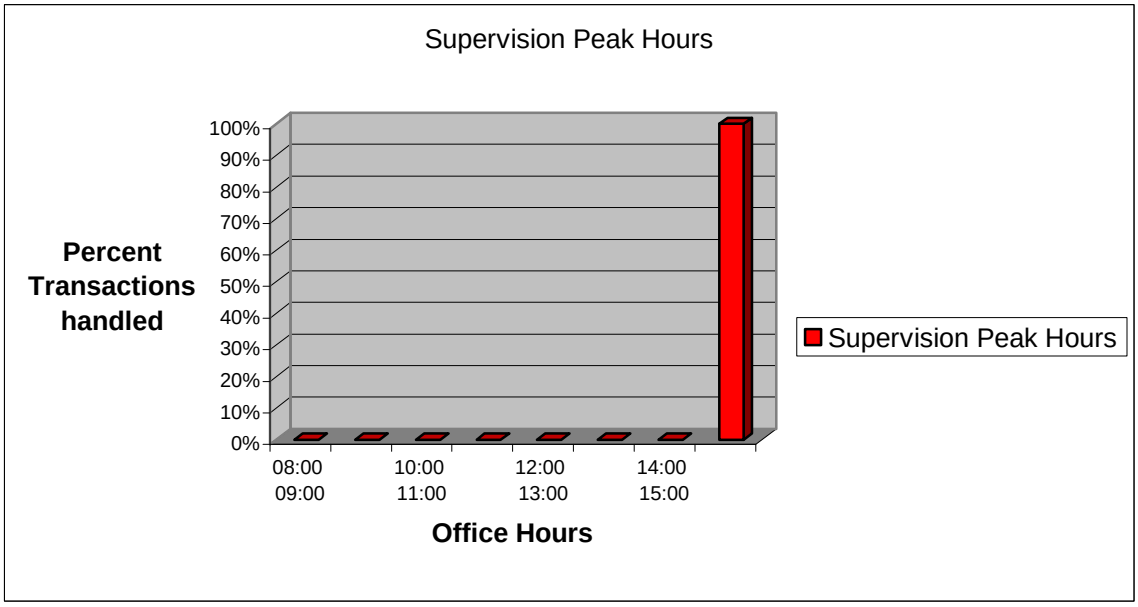


Table 4: Supervision Peak Hours

The calculation in this spreadsheet results in **The Required K-bits/sec** for each of the banks for the Supervision (EWS) application.

Sheet 5: Total Bandwidth Calculation

In sheet 5 we have summarized the total bandwidth requirements for the 3 mentioned applications.

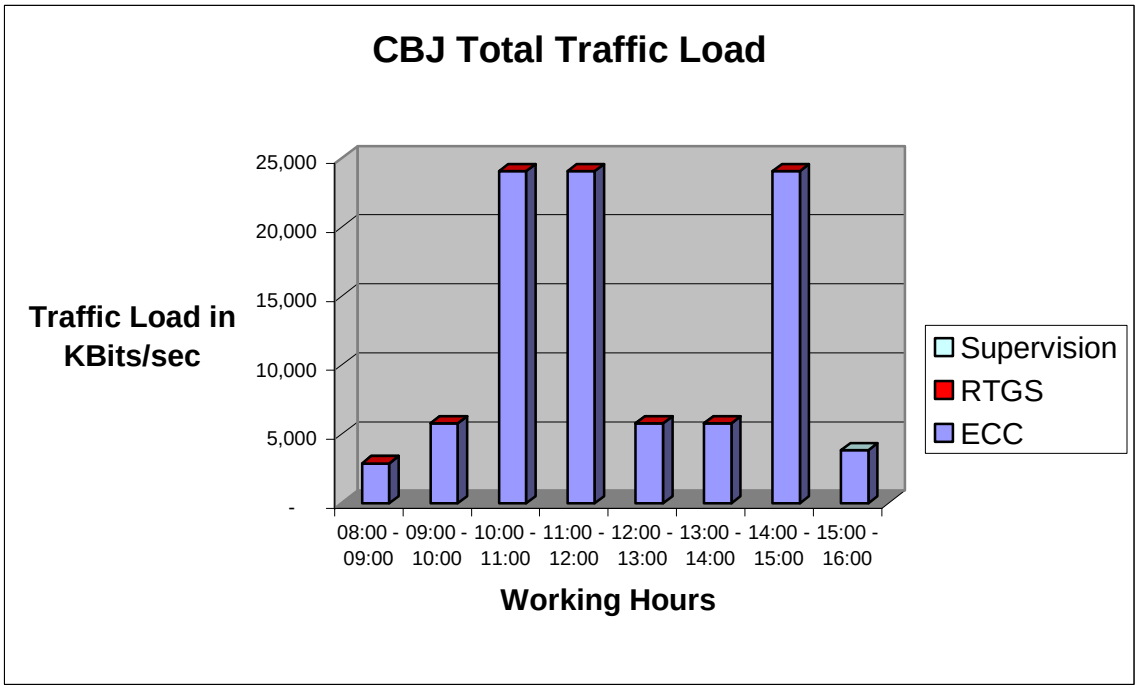


Table 5: Total required bandwidth

The final calculation is done on basis of a summary of K-bits/sec for all the traffic over the network. From this summary it can be seen that with applying the right truncations possibilities, a minimum of 24.8 Mb (around 12 E1 lines) is required to serve the mentioned applications (see also sheet 2, **Required line speed/bank**).

Sheet 1

Peak Day Checks Handling

		# Cheques on 29/12/2002	# Cheques on 30/12/2002	# Cheques on 31/12/2002	# Cheques on 14/7/2003	# Cheques on 15/7/2003	# Cheques on 16/7/2003	# Cheques on 17/7/2003	# Ch 29/7
0.	Central Bank	184	248	271	141	154	126	163	
	A. Commercial Banks								
1.	Arab Bank PLC.	11,063	20,856	19,169	7,795	14,140	6,392	5,730	
2.	Arab Banking Corporation (Jordan)	1,429	1,848	1,927	1,134	1,337	781	824	
3.	Bank of Jordan PLC	3,251	6,029	4,774	2,256	3,944	2,083	1,995	
4.	Cairo Amman Bank	1,303	1,813	1,834	973	982	1,407	3,747	
5.	Export & Finance Bank	271	342	445	206	344	175	133	
6.	Jordan Gulf Bank	1,743	2,616	3,544	845	675	864	571	
7.	Jordan Kuwait Bank	2,430	2,671	3,314	1,884	1,613	2,629	1,648	
8.	Jordan National Bank PLC	2,652	4,758	5,156	2,268	3,395	2,695	1,706	
9.	The Housing Bank for Trade & Finance	4,719	7,308	6,798	3,919	5,519	3,421	3,308	
	B.Foreign Banks.								
10.	Standard Chartered Grindlays Bank Ltd.	364	679	565	237	500	301	258	
11.	Egyptian Arab Land Bank	454	815	818	354	528	255	240	
12.	HSBC Bank Middle East	889	1,164	1,337	697	919	633	459	
13.	CitiBank	465	633	1,023	568	335	357	238	
14.	Rafidain Bank	10	13	12	9	3	3	6	
	C. Islamic Banks .								
15.	Islamic International Arab Bank PLC	718	2,019	1,241	408	1,023	425	358	
16.	Jordan Islamic Bank for Finance and Investment	3,682	4,903	7,510	3,088	2,443	3,559	1,950	
	D. Investment Banks.								
17.	Arab Jordan Investment Bank	473	956	706	326	492	233	256	
18.	Jordan Investment and Finance Bank	576	789	881	633	1,565	683	451	
19.	Middle East Investment Bank	795	1,063	1,140	601	959	484	304	
	Societe Generale de Banque au Liban								
20.	Philadelphia Investment Bank	144	384	236	64	68	57	62	
21.	Union Bank for Saving & Investment	639	1,545	1,565	773	1,374	616	916	
	Total	38,254	63,452	64,266	29,179	42,312	28,179	25,323	

Sheet 2

Cheque Handling Bandwidth Calculation

Cheques / branch / day

				Peak Hour Estimates			Kbits per second		
		Peak cheques/day	Peak 5% increase per year over 5 yrs	30% in 2 Hours	40% in 2 Hours	50% in 2 Hours	Per Bank in Kbits/sec	Per Bank in Kbits/sec	Per Bar Kbits/s
				Total number of cheques handle			ECC Traffic load of all interbank ch		
				Peak Hour from 10:00 - 12:00 Hr			30%	40%	50%
0.	Central Bank	271	**346**	104	138	173	32	42	
	A. Commercial Banks								
1.	Arab Bank PLC.	20,856	**26,618**	7,985	10,647	13,309	2,440	3,253	4
2.	Arab Banking Corporation (Jordan)	1,927	**2,459**	738	984	1,230	225	301	
3.	Bank of Jordan PLC	6,029	**7,695**	2,308	3,078	3,847	705	940	1
4.	Cairo Amman Bank	3,747	**4,782**	1,435	1,913	2,391	438	584	
5.	Export & Finance Bank	445	**568**	170	227	284	52	69	
6.	Jordan Gulf Bank	3,544	**4,523**	1,357	1,809	2,262	415	553	
7.	Jordan Kuwait Bank	3,398	**4,337**	1,301	1,735	2,168	398	530	
8.	Jordan National Bank PLC	5,156	**6,581**	1,974	2,632	3,290	603	804	1
9.	The Housing Bank for Trade & Finance	7,407	**9,453**	2,836	3,781	4,727	867	1,155	1
	B.Foreign Banks.								
10.	Standard Chartered Grindlays Bank Ltd.	679	**867**	260	347	433	79	106	
11.	Egyptian Arab Land Bank	818	**1,044**	313	418	522	96	128	
12.	HSBC Bank Middle East	1,337	**1,706**	512	683	853	156	209	
13.	CitiBank	1,023	**1,306**	392	522	653	120	160	
14.	Rafidain Bank	32	**41**	12	16	20	4	5	
	C. Islamic Banks .								
15.	Islamic International Arab Bank PLC	2,019	**2,577**	773	1,031	1,288	236	315	
16.	Jordan Islamic Bank for Finance and Investment	7,510	**9,585**	2,875	3,834	4,792	879	1,171	1
	D. Investment Banks.								
17.	Arab Jordan Investment Bank	956	**1,220**	366	488	610	112	149	
18.	Jordan Investment and Finance Bank	1,565	**1,997**	599	799	999	183	244	
19.	Middle East Investment Bank	1,140	**1,455**	436	582	727	133	178	
	Societe Generale de Banque au Liban								
20.	Philadelphia Investment Bank	384	**490**	147	196	245	45	60	
21.	Union Bank for Saving & Investment	1,680	**2,144**	643	858	1,072	197	262	
	Total	**71,923**	**91,794**	**27,538**	**36,718**	**45,897**	**8,414**	**11,219**	**14**

Sheet 3

RTGS transactions Bandwidth Calculation

				Peak Hour Estimates			
		Year 2002 RTGS transactions /day	5% increase over 5 yrs	30% in 2 Hours	40% in 2 Hours	50% in 2 Hours	Per Bank Kbits/se
				Total RTGS transactions handled			R
				Peak Hour from 10:00 - 12:00 Hr			30%
0.	Central Bank	25	32	10	13	16	0.03
	A. Commercial Banks						
1.	Arab Bank PLC.	85	108	33	43	54	0.10
2.	Arab Banking Corporation (Jordan)	18	23	7	9	11	0.02
3.	Bank of Jordan PLC	70	89	27	36	45	0.08
4.	Cairo Amman Bank	53	68	20	27	34	0.06
5.	Export & Finance Bank	4	5	2	2	3	0.00
6.	Jordan Gulf Bank	27	34	10	14	17	0.03
7.	Jordan Kuwait Bank	36	46	14	18	23	0.04
8.	Jordan National Bank PLC	49	63	19	25	31	0.05
9.	The Housing Bank for Trade & Finance	100	128	38	51	64	0.11
	B.Foreign Banks.						
10.	Standard Chartered Grindlays Bank Ltd.	11	14	4	6	7	0.01
11.	Egyptian Arab Land Bank	20	26	8	10	13	0.02
12.	HSBC Bank Middle East	3	4	1	2	2	0.00
13.	CitiBank	3	4	1	2	2	0.00
14.	Rafidain Bank	4	5	2	2	3	0.00
	C. Islamic Banks .						
15.	Islamic International Arab Bank PLC	12	15	5	6	8	0.01
16.	Jordan Islamic Bank for Finance and Investment	53	68	20	27	34	0.06
	D. Investment Banks.						
17.	Arab Jordan Investment Bank	16	20	6	8	10	0.01
18.	Jordan Investment and Finance Bank	8	10	3	4	5	0.00
19.	Middle East Investment Bank Societe General de Banque au Liban	15	19	6	8	10	0.01
20.	Philadelphia Investment Bank	8	10	3	4	5	0.00
21.	Union Bank for Saving & Investment	14	18	5	7	9	0.01
	E. Other Institutions						
22.	Securities Depository Center	21	27	8	11	13	0.02
	Total	655	836	251	334	418	0.

Sheet 4

Supervision Tranfers/ bank / day **100**

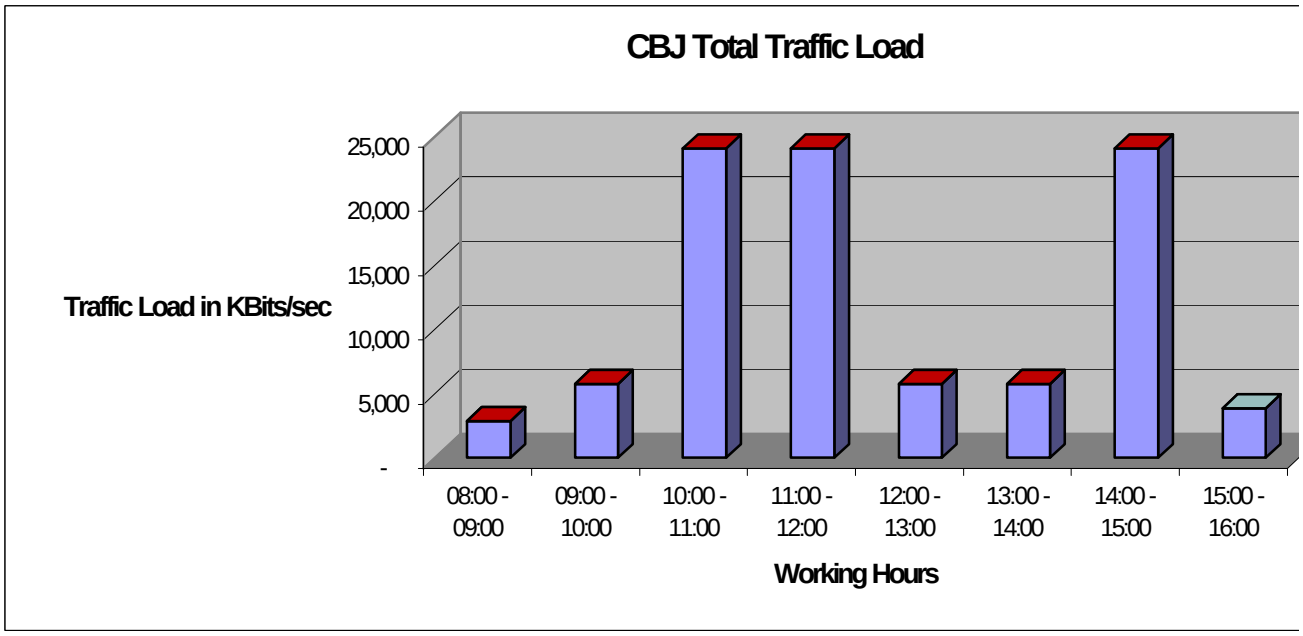
		# Supervision transactions /day	100% in after office hours	Per Bank in Kbits/sec
	A. Commercial Banks			
1.	Arab Bank PLC.	**100**	100	0.2503
2.	Arab Banking Corporation (Jordan)	**100**	100	0.2503
3.	Bank of Jordan PLC	**100**	100	0.2503
4.	Cairo Amman Bank	**100**	100	0.2503
5.	Export & Finance Bank	**100**	100	0.2503
6.	Jordan Gulf Bank	**100**	100	0.2503
7.	Jordan Kuwait Bank	**100**	100	0.2503
8.	Jordan National Bank PLC	**100**	100	0.2503
9.	The Housing Bank for Trade & Finance	**100**	100	0.2503
	B.Foreign Banks.			
10.	Standard Chartered Grindlays Bank Ltd.	**100**	100	0.2503
11.	Egyptian Arab Land Bank	**100**	100	0.2503
12.	HSBC Bank Middle East	**100**	100	0.2503
13.	CitiBank	**100**	100	0.2503
14.	Rafidain Bank	**100**	100	0.2503
	C. Islamic Banks .			
15.	Islamic International Arab Bank PLC	**100**	100	0.2503
16.	Jordan Islamic Bank for Finance and Investment	**100**	100	0.2503
	D. Investment Banks.			
17.	Arab Jordan Investment Bank	**100**	100	0.2503
18.	Jordan Investment and Finance Bank	**100**	100	0.2503
19.	Middle East Investment Bank Societe General de Banque au Liban	**100**	100	0.2503
20.	Philadelphia Investment Bank	**100**	100	0.2503
21.	Union Bank for Saving & Investment	**100**	100	0.2503
	E. Other Institutions			
22.	Securities Depository Center	**-**	-	-
	Total	**2,100**	**2,100**	**5.2565**

Sheet 5

Total Network Load

	Office Hours						
	08:00 - 09:00	09:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	1
ECC	2,891	5,782	24,090	24,090	5,782	5,782	
RTGS	0.0942	0.1883	0.7847	0.7847	0.1883	0.1883	
Supervision							
ic load Network inKbits/sec	2,891	5,782	24,091	24,091	5,782	5,782	
c load Network in bits/sec	2,960,276	5,920,551	24,668,964	24,668,964	5,920,551	5,920,551	

Minimum # E-1 (2MB) lines required based on peak traffic *12*



The Design

The network diagram as shown below outlines the design of the new WAN network for CBJ. In the design the following distinct areas can be distinguished :

1. The existing WAN/LAN Network as presently operational at CBJ
2. The Application Area in which future network dependent applications will be situated
3. Network Management Workstations for Intrusion Detection and Network Management
4. The new network equipment consisting of Routers, Switches, VPN Bundles (termination points) and IDS equipment.
5. Network Management (including IDS) Workstations

The Cisco 7206 XVR Routers are the main routers of the new CBJ Net. Each of these routers is equipped for the connection to a fiber optic cable and is equipped with a module for the connection of 30 dialup lines. Behind these routers and corresponding switches, 2 Cisco 3745 VPN Bundles are placed. At the VPN Bundles the VPN encryption security of the message coming from the network is terminated or VPN encryption security is initiated here for messages going to the network. Behind the VPN bundles and corresponding switches are the 2 firewalls. From the firewalls the network traffic is directed either to the existing WAN/LAN Network or to the Application area (ECC application). At various strategic points in the layout of the network equipment, Intrusion Detection Systems (IDS) Equipment has been placed.

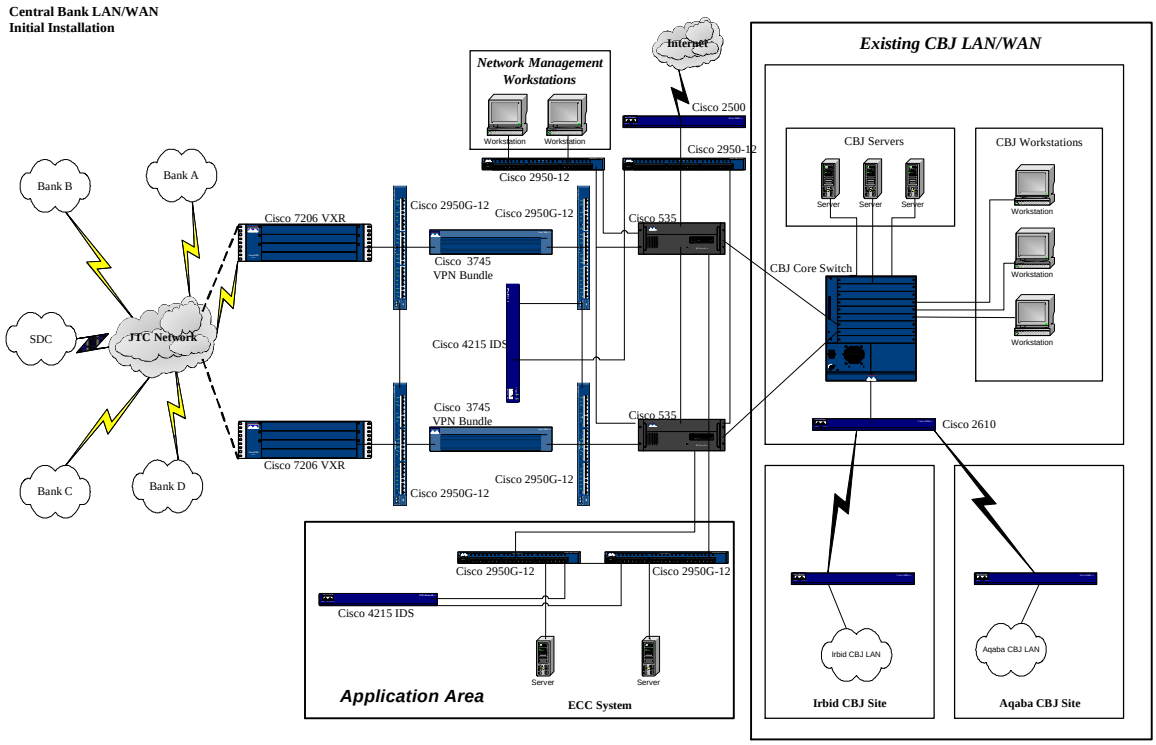


Diagram 4: CBJ New Network

Remark: The equipment as shown above does cater for the possibility of also being used in combination with a disaster recovery implementation at Irbid at a later stage. Given the importance of the RTGS systen and the new ECC application (future other applications) we do recommend CBJ to establish a disaster recovery site.

Design Notes and impediments:

Configuration Notes:

In the WAN design we have looked into the possibility of making the network as failsafe as possible. Given the design of the JTC network in Amman, the location of the Central Bank and the institutions (central Amman, Shmeisani), alternative connectivity to this network from another public exchange will be difficult to establish as all connections are routed via the main exchange (PABX) in central Amman. The biggest impediment we have encountered during the design of the network is related to failure in the JTC cabling structure. Although JTC mentioned that those failures are very rare, they form the biggest challenge for making the network more reliable and CBJ has voiced their concerns to JTC. The following situations to explain the impediments:

1) Most companies (and thus also the banks) are being connected to JTC via a single twisted pair cable. Telephone and all other data traffic are going through this single cable. In case of failure on this cable (equipment failure in PBX or PABX, cable cuts, etc.) all communication will be effected. Even the backup connection via dialup possibilities will fail to establish a connection as the dialup connection is making use of the same cable.
   a) JTC mentioned that in case of cable failure it is a matter of a few hours and the cable (copper) will be repaired by their service units.
   b) JTC also outlined that in some cases they have provided customers with alternative cabling (new duct and cable via other path) in order to prevent situation as mentioned above.
   c) AMIR proposes CBJ and the banks to review their network design and see if they can provided alternative routing (through their branch network) to be able to reach the CBJ network in case of failures of the above mentioned type occur.

2) The connection from JTC exchange to the CBJ head office will be a fiber optic cable. Same situation could occur on this single fiber cable.
   a) JTC mentioned that in case of fiber optic cable failure, the repair time is far longer than the repair of copper cables. It could take as long as 24 hours (or even more) before the cable has been repaired.
   b) JTC is willing to offer CBJ an alternative fiber optic cable in order to prevent cases in which the fiber optic cable is not more operational.

Proposed Implementation scenarios

Based on the information provided from JTC on the backup site connectivity options, the expected changes of the telecom market in Jordan in the next 6 to 12 months and the implementation plans for CBJ applications (mainly ECC), we have decided to implement the a Wide Area Network (WAN) for the CBJ main site, leaving the backup site consideration until the beginning of next year (2005), where other connectivity options could be available.

Equipment Specifications:

Detailed Equipment List

The following list specifies in detail the required communication networking equipment in detail.

No.	Unit	Qty	Item Description/unit
1	Firewall (Main Unit)	1	535UR Bundle (Chassis, unrestricted SW, 2 FE ports, 220 VAC)
		1	Redundant AC power supply for PIX 535 (220 Volts)
		2	Power Cord UK
		1	PIX v6.1 or above Software for the PIX Chassis
		1	PIX Four-port 10/100 Ethernet interface, RJ45
		1	Redundant AC power supply for PIX 535 (220 Volts)
		1	PIX 535 512MB RAM Upgrade (2-256MB DIMM)
		1	168-bit DES VPN feature license for PIX Firewall
		1	VPN Accelerator Card for PIX 515E/525/535-UR/FO Firewall
		1	Unrestricted feature license for PIX 535 Firewall
2	Firewall (Failover Unit)	1	535FO Bundle (Chassis, failover SW, 2 FE ports, 220 VAC)
		1	Redundant AC power supply for PIX 535 (220 Volts)
		2	Power Cord UK
		1	PIX v6.1 or above Software for the PIX Chassis
		2	66MHz Gigabit Ethernet Interface, Multimode (SX) SC
		1	PIX Four-port 10/100 Ethernet interface, RJ45
		1	Redundant AC power supply for PIX 535 (220 Volts)
		1	PIX 535 512MB RAM Upgrade (2-256MB DIMM)
		1	168-bit DES VPN feature license for PIX Firewall
		1	VPN Accelerator Card for PIX 515E/525/535-UR/FO Firewall
		1	Unrestricted feature license for PIX 535 Firewall
3	Collection Router	1	7206VXR with NPE-G1 and I/O Controller with 2 FE/E Ports
		1	Cisco 7200 AC Power Supply Option
		1	Cisco 7200 Redundant AC Power Supply Option, 280W
		2	Power Cord UK
		1	Cisco 7200 I/O PCMCIA Flash Disk, 128 MB Option
		1	256MB Memory for NPE-G1 in 7200 Series
		1	1 Port multichannel STM-1 single mode port adapter
		1	E1- ISDN PRI + Cable 10 Feet
4	Dial Backup Router	1	7206VXR with NPE-G1 and I/O Controller with 2 FE/E Ports
		1	Cisco 7200 AC Power Supply Option
		1	Cisco 7200 Redundant AC Power Supply Option, 280W
		2	Power Cord UK
		1	Cisco 7200 I/O PCMCIA Flash Disk, 128 MB Option
		1	256MB Memory for NPE-G1 in 7200 Series
		1	Auxiliary/Console Port Cable Kit
		1	1 Port multichannel STM-1 single mode port adapter
		1	E1- ISDN PRI + Cable 10 Feet
5	VPN Router	2	Cisco 3745 with VPN bundle, 220 VAC
		2	2 On-board 10/100 Mbps fast Ethernet ports
		2	128 MB Internal Flash Memory

		2	256 MB SDRAM System Memory
		2	Power Cord UK Ire HK Malaysia
6	IDS System	2	IDS 4215 Sensor (chassis, s/w, SSH, 2 10/100BaseT w/ RJ45 connector)
7	2nd Layer Switches	2	Catalyst 2950, 12 10/100, Enhanced Image
		2	Power Cord UK
8	2nd Layer Switches with GigaStack	6	Catalyst 2950, 12 10/100 with 2 GBIC slots, Enhanced Image
		6	Power Cord UK
		6	Giga Stack Stacking GBIC and 50cm cable
9	Cisco Works VMS	1	VMS 2.2 WIN/SOL Unrestricted; Inc VPNM CSPM; HIDS 3DES SW
10	Cisco Works for Windows	1	Cisco Works for Windows V6.1
11	Cables	1	Including fiber and RJ-45 cables enough to connect all equipment
12	Network Cabinet (to house all equipment)		42 U
			Appropriate Ventilation
			Glass fronted
			Full Standing
13	Hardware Installation		Hardware installation
14	Warranty		Extended 1 Year Warranty
15	Support and Maintenance		1 Year Support and Maintenance
16	Recommended Training	1	Building Scalable Cisco Networks
		1	Managing Cisco Network Security
		1	Building Cisco Multilayer Switched Networks
		1	Cisco Internetworking Troubleshooting
		1	Building Cisco Remote Access Networks
		1	Cisco Works2000 Fundamentals & LAN WAN
		1	Cisco Secure Intrusion Detection System
		1	Cisco Secure PIX Firewall Advanced Ver 2.0

Equipment Housing (Rack):

A 42 U Racks (see item 13 on the equipment specification list) will be supplied to house the equipment including Routers, Switches, and modem racks. The rack will help to keep the equipment in a very organized manner, and the rack will be equipped with the necesary connections and patch panels for reconfiguration.

Network Management System Specifications:

In order to be able to control the new CBJ Net, a Network Management System is required. The following are the basic and minimum requirement specifications for such a Network Management System.

General Specifications;

- Fast, Detailed, Monitoring and Diagnostic System.
- Remote monitoring up to 1000 nodes.
- LAN\WAN Performance Management Capabilities on device and Network Basis.
- Windows Operating System Interface.
- License for CBJ with technical Support.
- Security Features Supported.
- To be installed, implemented and tested in the CBJ Environment
- Orientation and training on the Network Management System for CBJ IT Technical Support Staff (approx. 6 Persons)

Network Discovery Capabilities;

- Discover Active devices on the network.
- Ability to Map Network Structure.
- Analyzing Switched Network (Mirror Port analysis).
- Manage Multi-Vendor of Network Devices.
- Support creating and executing monitoring Scripts

Problem Detection;

- Tracking and Identifying Problems Occurred due to network and configuration collisions and errors.
- Support a Real Time Alert System Events Notification.
- Remote (internet) connectivity for alert system

Documentation and Reporting;

- Collecting Comprehensive Information about Active Devices and Running Services on the network.
- Customizable diagrams and reports basis on the stored Information.

Intrusion Detection System Specifications

As security being one of the first priorities for big organizations and the greatest concerns for financial institutions, we are proposing CISCO IDS (Intrusion Detection System) hardware and software, CISCO is widely known for its products in the network and security field, The Cisco Intrusion Detection is designed to efficiently protect data and information infrastructure. With the increased complexity of security threats, achieving efficient network intrusion security solutions is critical to maintaining a high level of protection. Vigilant protection ensures business continuity and minimizes the effect of costly intrusions.

Our required IDS solution for the CBJ is the CISCO 4215 IDS, which belongs to the CISCO 4200 family series of IDS products.

The IDS system has to supply the following facilities :

- ? The ability to simultaneously protect multiple network subnets through the support for multiple sniffing;
- ? A wide array of performance options;
- ? Investment protection by delivering modular , up gradable components.
- ? Support for multi-VLAN traffic;
- ? Embedded web-based management solutions packaged with the IDS sensors
- ? Possibilities for other intrusion detection mechanisms (anomaly, missuse and others).

The Cisco IDS has to monitor up to 80Mbps of traffic and is suitable for T1/E1 and T3 environments. Additionally, multiple sniffing interfaces need to be supported onthe IDS, which allow the ability to simultaneously protect multiple subnets, thereby delivering five sensors in a single unit.

The Cisco IDS has to be able to support the following required performance:

- ? 800 new TCP connections per second.
- ? 800 HTTP transactions per second.
- ? Average packet size of 455 byte.
- ? Running Cisco IDS software version 4.0

Product requirement specifications:

- ? Performance : 80 Mbps.
- ? Standard monitoring software : 10/100 BASE-TX
- ? Standard command and control interface : 10/100 BASE-TX
- ? Optional Interface : four 10/100 BASE-TX (4FE) Sniffing interfaces allowing a total of 5 sniffing interfaces.
- ? Size : 1 U (Rack mounted)

Advanced Protection algorithm :

- ? state-ful pattern recognition
- ? protocol parsing.
- ? Heuristic detection.
- ? Anomaly detection.

Attack protection:

- ? Sweeps & floods,
- ? Denial of Services (DoS),
- ? Worms or Viruses,
- ? CGI attacks,
- ? Etc.

Secure Communication:

- ? IP Sec or SSL between sensor and management console.

- Encrypted signature packages.
- SSH for remote administration.
- Serial control protocol (SCP) support of secure file transfer.

IDS evasion protection:

- IP Fragmentation re-assembly.
- TCP stream re-assembly.

Active notification actions:

- E-mail,
- E-page,
- Alarm display,
- Etc.

Administration:

- Web user interface,
- Command line interface,
- TELNET,
- Etc.

Appendix A: Information Security Environment

Source: National Institute of Standards and Technology (NIST Document SP 500-53)

NIST SP 800-53 provides a method for categorizing security risk levels, *Standards for Security Categorization of Federal Information and Information Systems.* The recommendations and guidelines are based on factors such as how critical is a particular information system and the potential for harm to individuals (including privacy).

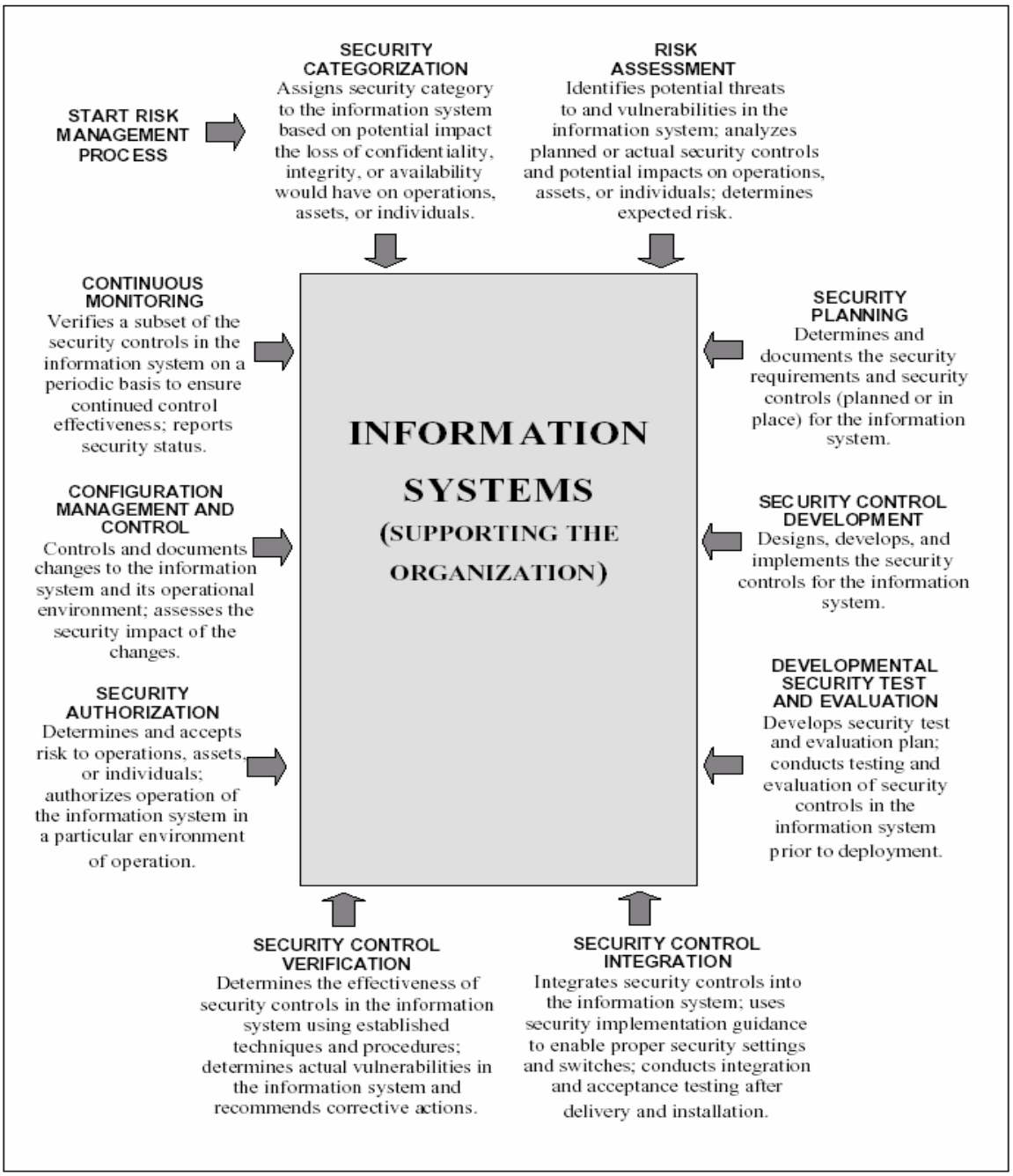


FIGURE 1: INFORMATION SECURITY PROGRAM ACTIVITIES